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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,738	12/02/2003	Shigeki Nojima	04329.3191	2083

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EXAMINER	
ROSASCO, STEPHEN D	

ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 09/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/724,738	NOJIMA ET AL.	
	Examiner	Art Unit	
	Stephen Rosasco	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 February 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1/13/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

The disclosure is objected to because of the following informalities: page 7, lines 13 and 23, "does" should be-dose-.

Appropriate correction is required.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-16 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-14 of copending Application No. 2003/0162105. Although the conflicting claims are not identical, they are not patentably distinct from each other because it would have been obvious to one to determine a monitor portion of the mask pattern, based on the calculated edge moving sensitivity, forming the mask pattern on the mask substrate, acquiring a dimension of a pattern included in that portion of the mask pattern formed on the mask substrate which corresponds to the monitor portion, determining evaluation value for the mask pattern formed on the mask substrate, based on the acquired dimension, and determining whether the evaluation value satisfies predetermined conditions.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nojima et al. (2003/0162105) in view of Tanaka et al. (6,567,972).

The claimed invention is directed to a method of manufacturing a photo mask comprising preparing mask data for a mask pattern to be formed on a mask substrate, calculating edge moving sensitivity with respect to each of patterns included in the mask pattern using the mask data, the edge moving sensitivity corresponding to a difference between a proper exposure dose and an exposure dose to be set when a pattern edge varies, determining a monitor portion of the mask pattern, based on the calculated edge moving sensitivity, actually forming the mask pattern on the mask substrate, acquiring a dimension of a pattern included in that portion of the mask pattern formed on the mask substrate which corresponds to the monitor portion, determining evaluation value for the mask pattern formed on the mask substrate, based on the acquired dimension, and determining whether the evaluation value satisfies predetermined conditions.

Nojima et al. teach a method of manufacturing a photomask comprising: determining dimensions of a pattern in a photomask including dimensions of critical pattern portions in which an exposure latitude is low; determining an exposure latitude on the basis of the dimensions of the mask; and judging if the photomask is defective or non-defective on the basis of whether or not the exposure latitude falls within a prescribed exposure latitude.

And wherein the dimensions of the pattern are determined including the dimensions of average dimension monitoring portions and the dimensions of dimension variation monitoring

portions, the average dimension monitoring portions being ones utilized for optimizing exposure conditions of an exposure system and the dimensions of dimension variation monitoring portions being ones utilized for calculating variations in the dimensions of the pattern.

And further comprising: performing a lithography simulation including process deviations on a par or the whole of the pattern to calculate values for the dimensions or shapes when the pattern is transferred onto a semiconductor wafer calculating deviations of the calculated values from design values; and extracting portions in which the deviations exceed a prescribed deviation or the deviations are the greatest as the critical pattern portions.

And wherein the process deviations include focus variations of the exposure system, exposure dose variations of the exposure system and/or lens aberration the exposure system.

The teachings of Nojima et al. differ from those of the applicant in that the applicant teaches determining a monitor portion of the mask pattern, based on the calculated edge moving sensitivity, actually forming the mask pattern on the mask substrate, acquiring a dimension of a pattern included in that portion of the mask pattern formed on the mask substrate which corresponds to the monitor portion, determining evaluation value for the mask pattern formed on the mask substrate, based on the acquired dimension, and determining whether the evaluation value satisfies predetermined conditions.

Tanaka et al. teach an exposure mask manufacturing apparatus comprising: a design data storage section configured to store design data of mask patterns; an OPC processing section connected to said design data storage section and configured to perform an OPC processing for compensating a critical dimension deviation and a shape deformation occurring between a pattern of an exposure mask and a pattern on a substrate due to optical proximity effects; and a mask writing unit configured to form an exposure mask according to mask writing data obtained by said OPC processing section; wherein said OPC processing section

comprises a mask pattern correction unit including: a correction section configured to correct a mask pattern so that at least one edge of a transferred pattern formed at a predetermined focal position with a previously-given exposure dose is located within a displacement from a desired pattern edge location, the displacement being determined to be smaller than a previously-set permissible edge displacement; and an additional correction section configured to add additional correction to the mask pattern in order to achieve a desired depth of focus with an exposure dose at a boundary of an exposure dose latitude.

And wherein said additional correction adds, as a correction value, a value obtained by dividing by a coefficient M a difference between an exposure dose for forming a desired edge displacement and the exposure dose latitude to a pattern not satisfying the permissible edge displacement depending upon a boundary of the exposure dose latitude in a defocus position for obtaining a desired focal depth, where if the exposure dose required for obtaining a desired position of the edge of the transferred pattern is changed by .DELTA.E when the edges of an interest to-be-corrected pattern is moved by .DELTA.L, the coefficient M is determined by the following equation: M= DELTA.E/DELTA.L.

It would have been obvious to one having ordinary skill in the art to take the teachings of Nojima et al. and combine them with the teachings of Tanaka et al. in order to make the claimed invention because it is well known that the problems of transferring a mask pattern from the mask to a substrate pattern are predominantly with the edges of the patterns.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kotani et al. (6,853,743) in view of Tanaka et al. (6,567,972).

The claimed invention is directed to a method of manufacturing a photo mask comprising preparing mask data for a mask pattern to be formed on a mask substrate, calculating edge moving sensitivity with respect to each of patterns included in the mask pattern using the mask data, the edge moving sensitivity corresponding to a difference between a proper exposure dose and an exposure dose to be set when a pattern edge varies, determining a monitor portion of the mask pattern, based on the calculated edge moving sensitivity, actually forming the mask pattern on the mask substrate, acquiring a dimension of a pattern included in that portion of the mask pattern formed on the mask substrate which corresponds to the monitor portion, determining evaluation value for the mask pattern formed on the mask substrate, based on the acquired dimension, and determining whether the evaluation value satisfies predetermined conditions.

The applicant discusses the limitations of the prior art in that conventionally, the photo mask specification has been determined so that desired exposure latitude is obtained even if all of items are the lowest limit value satisfying the specification. However, in actually manufactured photo masks, it is extremely rare that all items have the lowest limit value satisfying the specification. In many cases, a certain item exceeds the specification value while other items are within an allowable range of the specification value with margins. For this reason, there exists photo masks satisfying the desired exposure latitude in photo masks disposed as defective product.

Kotani et al. teach a mask pattern correction method used to form a desired pattern on a wafer by a projection optical system, comprising: a step of extracting a correction target edge from a design pattern; a step of calculating a length of the extracted correction target edge; a

first step of calculating correction value determined one-dimensionally by pattern layout perpendicular to the correction target edge when the length of the correction target edge calculated in the previous step is not smaller than a predetermined critical length; and a second step of calculating correction value determined two-dimensionally by pattern layout around the correction target edge when the length of the correction target edge calculated in the previous step is smaller than a predetermined critical length, the first step including: a distance calculation step of calculating a distance S from target edge to a nearest edge of an adjacent pattern perpendicularly; a step of calculating the correction value by one-dimensional simulation according to pattern layout perpendicular to the correction target edge, moving the correction target edge on a basis of the calculated correction value when the calculated distance S is smaller than a predetermined critical value S'; and a step of moving the correction target edge on the basis of a correction value set as a rule in advance using as a parameter at least one of the distance S, a line width W of the pattern including the correction target edge, and a line width W' of a pattern including an edge adjacent to the correction target edge when the calculated distance S is not smaller than the critical value S', and the second step including: a distance calculation step of calculating a distance sp from the correction target edge to a nearest edge in a perpendicular direction, and calculating a distance sh to a nearest edge in a direction of length; a step of calculating the correction value by two-dimensional simulation according to pattern layout around the correction target edge, and moving the correction target edge on the basis of the calculated correction value when at least either one of the distances sp and sh calculated in the distance calculation step is smaller than a corresponding one of predetermined distances sp' and sh'; and a step of moving the correction target edge on a basis of an edge moving amount set as a rule in advance using as a parameter at least one of the distances sp and sh, the line width W of the pattern containing the correction target edge,

and line widths wp and wh of patterns adjacent to the correction target edge when the calculated distance sp is not smaller than the critical distance sp', and the calculated distance sh is not smaller than the critical distance sh'.

The teachings of Kotani et al. differ from those of the applicant in that the applicant teaches determining a monitor portion of the mask pattern, based on the calculated edge moving sensitivity, actually forming the mask pattern on the mask substrate, acquiring a dimension of a pattern included in that portion of the mask pattern formed on the mask substrate which corresponds to the monitor portion, determining evaluation value for the mask pattern formed on the mask substrate, based on the acquired dimension, and determining whether the evaluation value satisfies predetermined conditions.

Tanaka et al. teach an exposure mask manufacturing apparatus comprising: a design data storage section configured to store design data of mask patterns; an OPC processing section connected to said design data storage section and configured to perform an OPC processing for compensating a critical dimension deviation and a shape deformation occurring between a pattern of an exposure mask and a pattern on a substrate due to optical proximity effects; and a mask writing unit configured to form an exposure mask according to mask writing data obtained by said OPC processing section; wherein said OPC processing section comprises a mask pattern correction unit including: a correction section configured to correct a mask pattern so that at least one edge of a transferred pattern formed at a predetermined focal position with a previously-given exposure dose is located within a displacement from a desired pattern edge location, the displacement being determined to be smaller than a previously-set permissible edge displacement; and an additional correction section configured to add additional correction to the mask pattern in order to achieve a desired depth of focus with an exposure dose at a boundary of an exposure dose latitude.

And wherein said additional correction adds, as a correction value, a value obtained by dividing by a coefficient M a difference between an exposure dose for forming a desired edge displacement and the exposure dose latitude to a pattern not satisfying the permissible edge displacement depending upon a boundary of the exposure dose latitude in a defocus position for obtaining a desired focal depth, where if the exposure dose required for obtaining a desired position of the edge of the transferred pattern is changed by .DELTA.E when the edges of an interest to-be-corrected pattern is moved by .DELTA.L, the coefficient M is determined by the following equation: M= DELTA.E/DELTA.L.

It would have been obvious to one having ordinary skill in the art to take the teachings of Kotani et al. and combine them with the teachings of Tanaka et al. in order to make the claimed invention because it is well known that the problems of transferring a mask pattern from the mask to a substrate pattern are predominantly with the edges of the patterns.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Rosasco
Primary Examiner
Art Unit 1756

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09/23/05